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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 08/889,440	Applicant(s) Takeuchi et al.
	Examiner Hugh Jones	Group Art Unit 2123

[X] Responsive to communication(s) filed on *Sep 25, 2000*

[ ] This action is **FINAL.**

[ ] Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle* 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

[X] Claim(s) *1, 3-9, 11-20, and 22-31* is/are pending in the applicat

Of the above, claim(s) ______ is/are withdrawn from consideration

[ ] Claim(s) ______ is/are allowed.

[X] Claim(s) *1, 3-9, 11-20, and 22-31* is/are rejected.

[ ] Claim(s) ______ is/are objected to.

[ ] Claims ______ are subject to restriction or election requirement.

Application Papers

[ ] See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

[ ] The drawing(s) filed on ______ is/are objected to by the Examiner.

[ ] The proposed drawing correction, filed on ______ is [ ] approved [ ] disapproved.

[ ] The specification is objected to by the Examiner.

[ ] The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

[X] Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

[X] All [ ] Some* [ ] None of the CERTIFIED copies of the priority documents have been

[X] received.

[ ] received in Application No. (Series Code/Serial Number) ______.

[ ] received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: ______

[ ] Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

[X] Notice of References Cited, PTO-892

[ ] Information Disclosure Statement(s), PTO-1449, Paper No(s). ______

[ ] Interview Summary, PTO-413

[ ] Notice of Draftsperson's Patent Drawing Review, PTO-948

[ ] Notice of Informal Patent Application, PTO-152

--- *SEE OFFICE ACTION ON THE FOLLOWING PAGES* ---

DETAILED ACTION

1. **Claims 1, 3-9, 11-20, 22-31 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.** The limitations of claims 20 and 22 are directed to a mathematical algorithm and abstract ideas. There is no pre- or post-computer solution activity. The limitations of claims 1, 3-9, 11-19 and 23-31 are directed to an *algorithm programed* on a computer. However, a claim directed at execution requires further consideration. The mere fact that a hardware element is recited in a claim does not necessarily limit the claim to a specific machine. *Cf.* In re *Iwahashi*, 888 F.2d 1370, 1374-75, 12 USPQ2d 1908, 1911-12 (Fed. Cir. 1989), *cited with approval in Alappat*, 33 F.3d at 1544 n.24, 31 USPQ2d at 1558 n.24. If a product claim encompasses *any* and every computer implementation of a process, when read in light of the specification, it should be examined on the basis of the underlying process. Such a claim is recognized as such because it will:

> - define the physical characteristics of the computer component exclusively as functions or steps to be performed on or by a computer, and
> - encompass *any and every* product in the stated class (e.g., computer, computer-readable memory) *configured in any manner* to perform that process.

Thus, even if the program were being executed, but there was no pre-processing or post-processing of real world data, i.e., *the underlying process was non-statutory*, the claims would not be statutory. ***As per remarks (pg. 6 of paper # 8 and pg. 11, paper # 19); what is the useful result of simulating phenomena of a "particle"?*** These claims represent abstract ideas without any concrete, tangible and useful application.

Claim Objections

2. **Claim 23 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim.** Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The preamble indicates that claim 23 is an *apparatus* claim - the limitations are *method* steps.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. **Claims 1, 3-9, 11-20 and 22-31 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.**

5. As per claims directed at "combined particles" (claims 1-9 and 11-31), Examiner has reviewed pp. 31-33 of the specification. The specification only describes the composition of the combined particles; but, does not describe how the components of the combined particle are combined. A reader would have to reinvent the invention. The meaning is not clear especially in

light of Applicant's various comments. Therefore, ***Examiner again repeats the request for a copy of Applicant's software package so that Examiner can determine what constitutes "combined".***

6. **Claims 1, 3-9, 11-20 and 22-31 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.**

7. As per claims directed at "combined particles" (claims 1-9 and 11-31), Examiner has reviewed pp. 31-33 of the specification. The specification only describes the composition of the combined particles; but, does not describe how the components of the combined particle are combined. A reader would have to reinvent the invention. The meaning is not clear especially in light of Applicant's various comments. Therefore, ***Examiner again repeats the request for a copy of Applicant's software package so that Examiner can determine what constitutes "combined".***

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. **Claim 23 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements.** See MPEP § 2172.01. The omitted elements are: The elements are not known, Applicant has only provided limitations directed at method steps, not apparatus limtations.

Claim Interpretations

10. In general, the applicants are disclosing method and apparatus to simulate physical interaction of adsorbates and a substrate. *There is an abundance of publications concerning this topic as well as animated display of such simulations*. The Applicant has emphasized the concept "*combined*" throughout the claims; if there is special significance to this term (such as a new interpretation pertaining to the *underlying physical interactions between particles*), it is not supported by the specification. The prior art rejections will be based on this interpretation of the specification and claims. Please note that due to numerous amendments and new art rejections, that all art rejections will be combined into one section (previously, new art rejections were separated from old art rejections).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 1, 3-9, 11-20, 22-31 are rejected under 35 U.S. C. 103 (a) as being unpatentable over (Misaka et al. *or* Baumann et al.) in view of the Examiner's own experience and the taking of Official Notice.

13. Misaka et al. disclose a dry-etching process simulator wherein a surface reaction model is used to simulate topological evolutions by taking into account the existence of adsorbed radicals on the substrate surface. Baumann et al. disclose 3D modeling of sputtering using a mesoscopic hard-sphere Monte Carlo model. (see fig. 1 of Baumann et al.). Baumann et al. simulate the behavior of *clusters* as they interact with a substrate (note that the use of ion cluster beams and molecular beams for deposition and/or sputtering are well known techniques; this phenomena has also been simulated.). Both sets of inventors are concerned with the simulating the dynamics of particles which are interacting with a substrate during processing of the substrate. The claims are reviewed and the contributions by each inventor, as outlined above, are noted.

14. As per claim 1, this is concerned with an apparatus for simulating phenomena of a combined particle formed of adsorbate particles and substrate particles, Misaka et al.: figs. 1, 2, 3b, 4, 5 ("calculate fluxes"); col. 1, lines 35-68; col. 2, lines 29-34 and 49-59; col. 3, lines 16-68; col. 4, lines 50-65; Baumann et al.: pg. 4.4.1 and fig. 1), **comprising: a kinetic condition setting unit** (this is inherent in particle simulators such as monte Carlo simulators) **which sets information for defining a plurality of generation periods and a corresponding number of adsorbate particles to be generated during each generation period** (Misaka et al.: figs. 1, 2, 3b, 4, 5 ("calculate fluxes"); col. 1, lines 35-68; col. 2, lines 29-34 and 49-59; col. 3, lines 16-68; col. 4, lines 50-65; Baumann et al.: pg. 4.4.1 and fig. 1)**; and**

a particle motion computing unit which generates the individual particles in accordance with the information set by the kinetic condition setting unit and computes

motion of the generated adsorbate particles, to simulate phenomena of the combined particle, each adsorbate particle having a corresponding emission source (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1,2; col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: pg, 4.4.1);

for each adsorbate particle, the kinetic condition setting unit sets a region indicating a position of the corresponding emission source (Misaka et al.: fig. 1, # 15; also inherent in figs. 2, 7, 8b, 10; Baumann et al.: inherent in fig. 1), and

the particle motion computing unit generates each adsorbate particle in accordance with the position of the corresponding emission source (Misaka et al.: fig. 1, # 15; Baumann et al.: inherent in fig. 1).

15. As per claim 3, this is concerned with an apparatus as in claim 1, wherein before generating the adsorbate particles, the particle motion computing unit generates the substrate particles (this would seem to be inherent as well as obvious; why generate particles which are to interact with a target if the target is not there; Misaka et al.: figs. 1, 2, 3b, 4, 5, 7, 8b, 9, 10; col. 1, lines 35-68; col. 3, lines 16-68; col. 4, lines 50-65; Baumann et al.: fig. 1; inherent in fig. 2).

16. As per claim 4, this is concerned with an apparatus as in claim 1, further comprising:

a display which allows a user to enter the information set by the kinetic condition setting unit (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

17. As per claim 5, this is concerned with an apparatus as in claim 1, wherein the kinetic condition setting unit sets information for generating the substarate particles (obviously, this information must be provided for each species; Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"),- col. 2, lines 29-34 and 49-59, Baumann et al.: pg. 4.4.1).

18. As per claim 6, this is concerned with an apparatus as in claim 1, wherein each adsorbate particle is formed of atoms (Misaka et al.: fig. 1 ("radical"), fig. 2, fig. 4 (b,c,d); Baumann et al. - fig. 1; pg. 4.4.1) - this is also *inherent*;

the information set by the kinetic condition setting unit includes information indicating whether the atoms of a respective adsorbate particle are static against center of mass of the adsorbate particle (inherent in clusters); **and**

when the particle motion computing unit generates an adsorbate particle and the information set by the kinetic condition setting unit indicates that the atoms of the respective adsorbate particle are not static against the center of mass, the particle motion computing unit provides a random orientation to the atoms of the adsorbate particle (Official notice is taken that this physical phenomena and approximations so as to take it into account in simulations were well known in the art at the time of the invention. [see for example

studies of ion attachment to electrodes submersed in salt solutions, studies of nucleation, or the motion of electrons around moving atoms or molecules]).

19. **As per claim 7, this is concerned with an apparatus as in claim 6, further comprising:**

a display which allows a user to enter the information set by the kinetic condition setting unit (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

20. **As per claim 8, this is concerned with an apparatus as in claim 1, wherein each adsorbate particle is formed of atoms** (Misaka et al.: fig. 1 ("radical"), fig. 2, fig. 4 (b,c,d); Baumann et al.: fig. 1; pg. 4.4.1),

the information set by the kinetic condition setting unit includes information indicating whether the smaller particles of a respective adsorbate particle are static against center of mass of the adsorbate particle (inherent in simulation of clusters), **and**

when the particle motion computing unit generates an adsorbate particle and the information set by the kinetic condition setting unit indicates that the atoms of the respective adsorbate particle are not static against the center of mass, the particle motion computing unit provides an initial velocity to the atoms of the absorbate (I assume the applicant is talking about molecules here? [in which case the parts of the molecule interact with each other via vibrational modes, and thus are not bound]) **particle** (Official notice is taken that this physical phenomena and approximations so as to take it into account in simulations were well

known in the art at the time of the invention. [see for example studies of ion attachment to electrodes submersed in salt solutions, studies of nucleation, or the motion of electrons around moving atoms or molecules]).

21. **As per claim 9, this is concerned with an apparatus as in claim 1, wherein, when generating an adsorbate particle, the particle motion computing unit provides a random direction within a cone pointed at a substrate and being centered at a point of generation of center of mass velocity of the adsorbate particle** (this is inherent in particle simulations in general, and in Monte Carlo simulations, in particular [see for example studies of gaseous discharges wherein an electron is emitted from a cathode or an electron is ejected from an atom due to collisional ionization]).

22. **As per claim 11, this is concerned with an apparatus as in claim 1, further comprising a display which displays the information set by the kinetic condition setting unit** (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

23. **As per claim 12, this is concerned with an apparatus for simulating phenomena of a combined particle formed of adsorbate particles and substrate particles, each adsorbate particle having a corresponding emission source, the apparatus comprising:**

an input device which allows a user to designate a region (this is standard with respect to particle simulators in general. I have seen done this as it pertains to Monte Carlo simulation [specifying the position of the cathode which is to eject electrons]; Misaka et al.: figs, 1, 5, 7, 8b,

9, 10- Baumann et al.: inherent in fig. 1);

a kinetic condition setting unit which, for each adsorbate particle, sets the region designed by the user as a region indicating a position of the corresponding emission source (Misaka et al. fig. 1, # 15; Baumann et al.: inherent in fig. 1); **and**

a particle motion computing unit which generates the adsorbate particles in accordance with the position of the corresponding emission source as indicated by the region designated by the user and computes motion of the generated adsorbate particles, to simulate phenomena of the combined particle (Misaka et al.: fig. 1, # 15; fig. 5 - Baumann et al.: pg. 4.4.1).

24. As per claim 13, this is concerned with an apparatus as in claim 12, wherein the input device is a display (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

25. As per claim 14, this is concerned with an apparatus as in claim 12, further comprising a display which displays the information set by the kinetic condition setting unit (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

26. As per claim 15, this is concerned with an apparatus as in claim 14, wherein the display shows the adsorbate particles generated by the particle motion computing unit and indicates the motion computed by the particle motion computing unit (this is standard in the

art; I have seen this type of display at conferences [Official notice is taken that this feature was well known in the art at the time of the invention.).

27. As per claim 16, this is concerned with an apparatus for simulating phenomena of a combined particle formed of adsorbate particles and substrate particles, comprising:

a kinetic condition setting unit (this is inherent in particle simulators such as monte Carlo simulators) **which sets information for defining kinetic conditions of the adsorbate particles** (Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: pg. 4.4.1); **and**

a particle motion computing unit which generates the adsorbate particles in accordance with the information set by the kinetic condition setting unit and the position of the corresponding emission source and computes motion of the generated adsorbate particles, to simulate phenomena of the combined particle, each adsorbate particle having a corresponding emission source (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1, 2 col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: pg. 4.4.1).

28. As per claim 17, this is concerned with an apparatus as in claim 16, wherein

the adsorbate particles move towards the substrate particles (Misaka et al. - fig. 1, 2, 3b; Baumann et al.: fig. 1),

the kinetic condition setting unit sets a region for defining an initial position of the adsorbate particles (Misaka et al.: figs. 1, 5; Baumann et al.: inherent on pg. 4.4.1),

the apparatus further comprises a display which displays the relationship between the region set by the kinetic condition setting unit and a region indicating a position of a substrate particle forming the combined particle (this is standard in the art; I have seen this type of display at conferences [Official notice is taken that this feature was well known in the art at the time of the invention.]).

29. **As per claim 18, this is concerned with an apparatus as in claim 17, wherein**

the kinetic condition setting unit sets information for providing a direction of velocity to the adsorbate particles (Misaka et al.: fig. 1 # 15; Baumann et al.: inherent on pg. 4.4.1), **and**

the display shows the direction of velocity with respect to the region set by the kinetic condition setting unit and the region indicating the position of a respective substrate particle (this is standard in the art; I have seen this type of display at conferences [Official notice is taken that this feature was well known in the art at the time of the invention.]).

30. **As per claim 19, this is concerned with an apparatus as in claim 16, further comprising a display which displays the information set by the kinetic condition setting unit** (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

31. **As per claim 20, this is concerned with a computer-implemented method for simulating phenomena of a combined particle formed of adsorbate particles and substrate**

particles, each adsorbate particles having a corresponding emission source, the method comprising the steps of:

setting information for defining a plurality of generation periods and a corresponding number of adsorbate particles to be generated during each generation period (Misaka et al.: fig. 1, # 15; Baumann et al.: inherent on pg. 4.4.1);

generating the adsorbate particles in accordance with the information set in the setting step and the position of the corresponding emission source (Misaka et al.: fig. 1, # 15; Baumann et al.: inherent on pg. 4.4.1), **and**

computing motion of the generated adsorbate particles, to simulate phenomena of the combined particle (again, this is inherent in particle simulators such as Monte Carlo simulators, Misaka et al.: abstract; fig. 1, 2; col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: pg. 4.4.1).

32. As per claim 22, this is concerned with a computer-implemented method for simulating phenomena of a combined particle formed of adsorbate particles and substrate particles, each adsorbate particle having a corresponding emission source, the method comprising the steps of

setting, for each adsorbate particle, a region indicating a position of the corresponding emission source (this is standard with respect to particle simulators in general. I have seen done this as it pertains to Monte Carlo simulation [specifying the position of the

cathode which is to eject electrons]; Misaka et al.: figs, 1, 5, 7, 8b, 9, 10; Baumann et al.: inherent on pg. 4.4.1),

generating the adsorbate particles in accordance with the position of the corresponding emission source as indicated by the region set in the setting step (Misaka et al.: fig. 1, # 15; Baumann et al.: inherent on pg. 4.4.1);

computing motion of the generated adsorbate particles, to simulate phenomena of the combined particle (Misaka et al.: fig. 1, # 15; Baumann et al.: pg. 4.4. 1); and

simulating phenomena of the combined particle in accordance with the computed motion.

33. As per claim 23, this is concerned with an apparatus for simulating phenomena of a combined particle formed of adsorbate particles and substrate particles, comprising:

setting information for defining kinetic conditions of the adsorbate particles;

displaying the set information (Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: inherent on pg. 4.4.1);

generating the adsorbate particles in accordance with the set information and the positions of the corresponding emission sources (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1,2;
col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: inherent on pg. 4.4.1); and

computing motion of the generated adsorbate particles, to simulate phenomena of the combined particle, each adsorbate particle having a corresponding emission source (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1, 2; col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: pg. 4.4.1).

34. As per claim 24, this is concerned with an apparatus for simulating phenomena of a combined particle formed with adsorbate particles, comprising:

a kinetic condition setting unit (this is inherent in particle simulators such as monte Carlo simulators) **which sets information for defining kinetic conditions of the adsorbate particles** (Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: inherent on pg. 4.4.1), and

a particle motion computing unit which generates the adsorbate particles in accordance with the information set by the kinetic condition setting unit and computes motion of the generated adsorbate particles, to simulate phenomena of the combined particle, each adsorbate particle having a corresponding emission source (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1,2; col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: pg. 4.4.1);

for each adsorbate particle, the kinetic condition setting unit sets a region indicating a position of the corresponding emission source (Misaka et al.: fig. 1, # 15; also inherent in figs. 2, 7, 8b, 10; Baumann et al.: inherent on pg. 4.4.1), **and**

the particle motion computing unit generates each adsorbate particle in accordance with the position of the corresponding emission source as indicated by the region set by the kinetic condition setting unit (Misaka et al.: fig. 1, # 15; Baumann et al.: pg. 4.4.1).

35. **As per claim 25, this is concerned with an apparatus as in claim 24, wherein the information set by the kinetic condition setting unit** (this is inherent in particle simulators such as Monte Carlo simulators) **defines a plurality of generation periods and a corresponding number of adsorbate particles to be generated during each generation period by the particle motion computing unit** (Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: inherent on pg. 4.4.1).

36. **As per claim 26, this is concerned with an apparatus as in claim 24, wherein the combined particle is formed with adsorbate particles and substrate particles,**

the information set by the kinetic condition setting unit includes information for defining kinetic conditions of the substrate particles (Misaka et al.: figs. 1, 2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: inherent on pg. 4.4.1); **and**

the particle motion computing unit generates the substrate particles before generating the adsorbate particles (this would seem to be obvious; why generate particles which are to interact with a target if the target is not there; Misaka et al.: figs. 1, 2, 4, 5, 7, 8b, 9, 10; Baumann et al.: pg. 4.4.1).

37. **As per claim 27, this is concerned with an apparatus as in claim 24, wherein**

the combined particle is formed with adsorbate particles and substrate particles,

each substrate particle includes a fixed particle and a temperature control particle (Baumann et al.: temperatue: fig. 6]),

the information set by the kinetic condition setting unit includes information for defining kinetic conditions of the fixed particle and the temperature control particle (Misaka et al.: figs. 1,.2, 5 ("calculate fluxes"); col. 2, lines 29-34 and 49-59; Baumann et al.: inherent on pg. 4.4.1), **and**

the particle motion computing unit generates the fixed particle and the temperature control particle of each substrate particle in accordance with the information set by the kinetic condition setting unit (again, this is inherent in particle simulators such as Monte Carlo simulators; Misaka et al.: abstract; fig. 1,2; col. 2 lines 49-59 and 59-64; col. 3, lines 3-68; col. 4, lines 1-6; Baumann et al.: inherent on pg. 4.4.1).

38. **As per claim 28, this is concerned with an apparatus as in claim 24, further comprising a display which displays the information set by the kinetic condition setting unit** (this is standard with respect to particle simulators in general. I have personally done this as it pertains to Monte Carlo simulations).

39. **As per claim 29, this is concerned with an apparatus as in claim 24, wherein each adsorbate particle includes a plurality of atoms** (Misaka et al.: fig. 1 ("radical"), fig. 2, fig. 4 (b,c,d); Baumann et al. fig. 1);

the information set by the kinetic condition setting unit includes information indicating whether the atoms of a respective adsorbate particle are static against center of mass of the adsorbate particle (inherent in simulation of clusters); **and**

when the particle motion computing unit generates an adsorbate article and the information set by the kinetic condition setting unit indicates that the atoms of the respective adsorbate particle are not static against center of mass, the particle motion computing unit provides a random orientation to the atoms of the adsorbate particle (Official notice is taken that this physical phenomena and approximations so as to take it into account in simulations were well known in the art at the time of the invention. [see for example studies of ion attachment to electrodes submersed in salt solutions, studies of nucleation, or the motion of electrons around moving atoms or molecules]).

40. As per claim 30, this is concerned with an apparatus as in claim 29, wherein, when the particle motion computing unit generates an adsorbate particle and the information set by the kinetic condition setting unit indicates that the atoms of the respective adsorbate particle are not fixed against center of mass, the particle motion computing unit provides an initial velocity to the atoms of the adsorbate particle (Official notice is taken that this physical phenomena and approximations so as to take it into account in simulations were well known in the art at the time of the invention. [see for example studies of ion attachment to electrodes submersed in salt solutions, studies of nucleation, or the motion of electrons around moving atoms or molecules]).

41. **As per claim 31, this is concerned with an apparatus as in claim 24, wherein, when generating an adsorbate particle, the particle motion computing unit provides a random direction within a cone pointed at a substrate and being centered at a point of generation of center of mass velocity of the adsorbate particle** (Official notice is taken that this physical phenomena and approximations so as to take it into account in simulations were well known in the art at the time of the invention. [see for example studies of ion attachment to electrodes submersed in salt solutions, studies of nucleation, or the motion of electrons around moving atoms or molecules]).

42. **Claims 1, 3-9, 11-20, 22-26 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over (Yamada et al. *or* Misaka et al. *or* Baumann et al. *or* Husinsky et al.) in view of (Kinema/SIM <u>or</u> Reeves <u>or</u> Cohen).**

43. Yamada et al. discloses details of a Monte Carlo simulation of sputtering. See entire disclosure. <u>Especially note fig. 1-3</u>.

44. Misaka et al. disclose a dry-etching process simulator wherein a surface reaction model is used to simulate topological evolutions by taking into account the existence of adsorbed radicals on the substrate surface. See figs. 1, 2, 3b, 4, 5 ("calculate fluxes"); col. 1, lines 35-68; col. 2, lines 29-34 and 49-59; col. 3, lines 16-68; col. 4, lines 50-65.

45. Baumann et al. disclose 3D modeling of sputtering using a mesoscopic hard-sphere Monte Carlo model. (see fig. 1 of Baumann et al.). Baumann et al. simulate the behavior of *clusters* as they interact with a substrate (note that the use of ion cluster beams and molecular beams for

deposition and/or sputtering are well known techniques; this phenomena has also been simulated.). See pg. 4.4.1 and fig. 1-2.

46. Husinsky et al. disclose "*Fundamental aspects of SNMS for thin film characterization: Experimental studies and computer simulations.*" They further disclose that the idea of secondary neutral mass spectroscopy (SNMS) as a tool for surface analysis dates back to the early 1970s. Recently, due to the development of new and effective post ionization tools, i.e. lasers, this method has become an interesting alternative to more conventional methods for various applications in surface analysis, as for instance depth profiling or characterization of thin films. SNMS, in general, involves a more complicated apparatus than other techniques, due to the additional post-ionizing stage. However, in the last few years it has been demonstrated by many groups that for several situations SNMS offers substantial advantages as compared with conventional methods, in particular secondary ion mass spectrometry. In this paper they evaluate the current situation of SNMS, in particular laser-SNMS, for applications related to the field of thin film research. On behalf of experimental studies and ***computer simulations of various phenomena related to SNMS*** they show the possibilities, advantages and also problems associated with the method. See section 4 (sputtering) including section 4.1 (sputtered flux - fig. 4, 9 and 16 - showing combined particles); section 4.3 (computer simulation of sputtering) and section 4.4 (cluster emission).

47. (Yamada et al. *or* Misaka et al. *or* Baumann et al. *or* Husinsky et al.) discloses all claim limitations except for a teaching animation of the simulation. (Kinema/SIM *or* Reeves *or* Cohen)

teach that it was obvious and well known to one of ordinary skill in the art at the time of the invention to animate simulations of physical processes. (Kinema/SIM *or* Reeves *or* Cohen) provide details about animations of particles. The teachings of (Kinema/SIM *or* Reeves *or* Cohen) are subsequently presented.

48. Kinema/SIM is a software tool that presents a simulation space for particle behavior where you can construct and animate complex physical phenomena. See entire disclosure. A number of features are subsequently listed for Applicant's benefit.

- Examples of the graphical interface are shown on pp. 1-8 to 1-9;
- the "particle window" is shown on pg. 2-7; here the particle parameters can be altered;
- "Lifetime" defines the particle lifetime (pg. 2-9);
- "particle geometry" is discussed on pg. 2-11;
- "coordinate systems" are discussed on pg. 3-3;
- entering particle parameter values via slider buttons (pg. 3-10;
- probibility functions for particle speed, lifetime, emission angles (pg. 3-11);
- other relevant temporal parameters (pg. 3-16);
- GUI simulation controls (pg. 5-2);
- statistical features (ie., *group behavior* - pg. 5-3);
- particles, obstacles (pg. 5-5);
- deatils about simulation parameter values including source rate, display, particle interactions and emission sources (chapter 6);

- range of interactions between particles (pg. 6-3);

- source rate (pg. 6-4);

- a combined particle (pg. 6-5), wherein

"The Euler mode, on the other hand, calculates forces more globally and therefore has the advantage of maintaining simulation speed. It calculates only one force per cell at time t, which is applied to ***all particles in the cell.*** *...";*

- Chapter 7 discloses "Particles";

- particle coupling (pg. 7-1);

- particle examples (pg. 7-1), wherein

"Particles are the key element in Kinema/SIM simulations. They are point objects that can represent a broad range of physical and image characteristics such as mass, charge, color, motion and geometry. In your simulation, particles can represent a diversity of real or image objects such as quantum physics particles, gas molecules, aerosol droplets, bacteria, fluid flow, dust, rain, snow, sand, or pixels of images. The possibilities are as numerous as the phenomena of reality and creative animtion ...

... Particles are emitted into the simulation via sources which can be visible or invisible points or geometric objects positioned in simulation space. ...";

- particles parameter window (pg. 7-3 to 7-4);

- *"Sigma", a parameter related to particle-particle interactions* (pp. 7-13 to 7-14);

- decay particles (pg. 7-21);

- particle coupling (pp. 7-22 to 7-23);

- Chapter 8 (source parameters);

- sources (pg. 8-1), wherein

"Sources are orgins that emit particles into the simulation, and all particles must enter the simulation via a source. Sources can be points or have spatial geometry which you can choose to see or hide in simulation space. You can define as many sources as you like for a system, but each source is restricted to emit only one particle type. (If you want to have more than one particle type originate from the same position, you can superimpose sources at the point. ...

... In the source window you assign a particle type to the source and then define the rate and speed of the particles along with their spread angle into the simulation. ..."

<u>The "spread angle" is Applicant's "cone".</u>;

- source window (pg. 8-3);
- source rate (pg. 8-4);
- **<u>Spread</u>** (pg. 8-5);
- speed (pg. 8-6);
- source position (pg. 8-10);
- display (pg. 8-11);
- geometry (pg. 8-13);
- particle emission and geometry (pp. 8-15 to 8-16);
- particle generation (pp. 8-16 to 8-17);
- Chapter 9 "Obstacles";
- Chapter 13, "electric fields";
- Chapter 15, "particle events";

- <u>elastic and inelastic particle collisions</u> (pp. 15-1 to 15-2);

49. Reeves discloses animation of particle behavior and discloses the concept of combined particle. On page 91,

> *"First, an object is represented not by a set of primitive surface elements, such as polygons or patches, that define its boundary, but as clouds of primitive particles that define its volume."*

Section 2.1 discloses particle generation. Section 2.2 discloses:

> *"For each new particle generated, the particle system must determine values for the following attributes:*
>
> *(1) initial position,*
>
> *(2) initial velocity (both speed and direction),*
>
> *(3) initial size,*
>
> *(4) initial color,*
>
> *(5) initial transparency,*
>
> *(6) shape,*
>
> *(7) lifetime.*

Section 2.3 discloses particle dynamics.

50. Cohen discloses "*Computer animations, quantum mechanics and elementary particles.*" See entire disclosure. The following is from pg. 165;

> *"In a typical animation, starting from a small number of virtual particles, the number tends to increase as a function of time, signaling the deviation from the physical states. <u>A physical particle contains a cloud of finite size of virtual particles.</u> The animation actually allows us to see the formation of such clouds. It is rather amusing to identify <u>dressed objects</u> mainfesting <u>collective behavior</u>, and then analyze the space renormalization group of the clouds by zooming in."*

On page 166, the following is found:

> *The visualization "dictionary" developed for computer animations of quantum systems* ***can be applied to any process following the rules of one or several of Nature's fundamental interactions. Animation of various atomic and subatomic phenomena*** *such as electron orbitals, particle collisions, radiactive decay, fusion, fission, etc. are therefore feasible and instructive."*

51. Claims 1, 3-9, 11-20 and 22-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over [Ohira et al. (Applicant - Applicant's IDS).] in view of (Kinema/SIM *or* Reeves *or* Cohen).

52. Ohira et al. discloses details of a Molecular-dynamics simulation of sputtering. See: abstract; pg. 2 (Theoretical Methods) and especially fig. 1.

53. [Ohira et al.] discloses all claim limitations (**see fig. 1 - temperature control particles**) except for a teaching of animation of the simulation. (Kinema/SIM *or* Reeves *or* Cohen) teach that it was obvious and well known to one of ordinary skill in the art at the time of the invention to animate simulations of physical processes. (Kinema/SIM *or* Reeves *or* Cohen) provide details about animations of particles. The teachings of (Kinema/SIM *or* Reeves *or* Cohen) were presented earlier.

Response to Arguments

54. Applicant's arguments filed 12/5/2000 have been fully considered but they are not persuasive.

Regarding the 101 rejections (page 11, paper 19):

55. ***Applicant has not provided a useful, concrete and tangible result.*** The Examiner respectfully offers the following:

Patent Act, Section 101:

The Examiner reminds Applicant that disclosing a practical application for an invention is a long-established requirement.

> ***We think it is now settled that an invention cannot be considered as having been reduced to practice in the sense that a patent can be granted for it unless a practical utility for the invention has been discovered where such utility would not be obvious.*** **See 35 U.S.C. 101;** Brenner v. Manson, 383 U.S. 519, 148 USPQ 689 **(1966)**; In re Kirk, 54 CCPA 1119, 376 F.2d 936, 153 USPQ 48 **(1967)**; In re Joly, 54 CCPA 1159, 376 F.2d 906, 153 USPQ 45 **(1967)**.

See In re Kawai, 178 U.S.P.Q 158, 163 (BNA) (C.C.P.A. **1973**) (Senior J. Almond writing for the unanimous court, *en banc*).

Patent Act, Section 112:

The Examiner notes Applicant's statement in the amendment, in which Applicant states (page 11):

> "*simulating phenomena of a combined particle*"

Applicants are reminded that ***the claimed invention must be limited to a practical application***. Mere allegations that the claimed invention ***could be useful*** for some purpose, without support in the written description showing "the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or

with which it is most nearly connected, to make and use the same" does not meet the requirements defined in the Patent Act, section 112, first paragraph.

56 As described in sections 2163-2164 of the Manual of Patent Examining Procedure, an applicant must show ***how to make the claimed invention*** (MPEP 2164.01(b)), and ***how to use the claimed invention*** (MPEP 2164.01(c)). An applicant is not required to provide a working example (MPEP 2164.02). However, when an applicant does not provide an example showing ***actual reduction to practice***, the applicant ***must demonstrate constructive reduction to practice*** to demonstrate possession of the invention. *See In re Brandstadter,* 179 USPQ 286 (BNA) (C.C.P.A. 1973), wherein Judge Rich, writing for the *unanimous in banc* court, upheld a decision by the Board of Appeals, affirming a rejection by a patent examiner under section 112, first paragraph, for failure to teach how to properly make and use the claimed invention.

57. The Examiner interprets, with respect to the practical application asserted by the Applicant, that the Applicant has not disclosed how to use the claimed invention for a practical purpose within the written description. ***The written description must teach a practical application for the claimed invention to establish constructive reduction to practice.***

> It is well understood that the act of filing a United States patent application can be regarded as being a constructive reduction to practice of an invention described therein as of the filing date. It follows naturally from this that ***the written specification in the application is the evidence proving the invention of that which is reduced to practice***, i.e., the subject matter to which properly supported claims can be drawn.
>
> ***We think it is now settled that an invention cannot be considered as having been reduced to practice in the sense that a patent can be granted for it unless a practical utility for the invention has been discovered where such utility would not be obvious.***

> **See 35 U.S.C. 101;** Brenner v. Manson, 383 U.S. 519, 148 USPQ 689 (1966); In re Kirk, 54 CCPA 1119, 376 F.2d 936, 153 USPQ 48 (1967); In re Joly, 54 CCPA 1159, 376 F.2d 906, 153 USPQ 45 (1967). *Therefore, a constructive reduction to practice, as opposed to an actual reduction to practice, is not proven unless the specification relied upon discloses a practical utility for the invention where one would not be obvious.* ***We also think that proof of a constructive reduction to practice would also require that there be sufficient disclosure in the specification to enable any person skilled in the art to take advantage of that utility where it would not be obvious how this is done. This latter requirement is, of course, the so-called "how to use" requirement of section 112.***

See Kawai at 163. The Examiner further notes the requirements expressed in MPEP 2164.05 :

> Once the examiner has weighed all the evidence and established a reasonable basis to question the enablement provided for the claimed invention, ***the burden falls on applicant to present persuasive arguments, supported by suitable proofs where necessary***, that one skilled in the art would be able to make and use the claimed invention using the *application* as a guide. In re Brandstadter , 484 F.2d 1395,1406 - 07, 179 USPQ 286, 294 (CCPA 1973). The evidence provided by applicant need not be conclusive but merely convincing to one skilled in the art.

58. Finally, **simulation of a fictious particle is *not* a practical application.**

Regarding the 112(1) rejections (pages 12-13, paper 16):

59. As per claims directed at "*combined particles*" (first two full paragraphs, page 12), Examiner has reviewed pp. 31-33 of the specification. The specification only describes the possible composition of the combined particles; but, does not describe *how* the components of the combined particle are combined. The meaning is not clear especially in light of Applicant's various comments in paper # 9 as well as those provided in paper # 16. The matter is still not resolved in paper # 19 (pg. 12). Therefore, ***Examiner again repeats the request for a copy of Applicant's software package so that Examiner can determine what constitutes "combined"***.

Representative is reminded that the claims were rejected under 35 U.S.C. 112, first paragraph, because *they contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.* In response, Representative simply asserts that it does not matter how the particles are combined. How could *one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention*, namely combined particles, if the *subject matter was not adequately described in the specification? Furthermore, it is noted that Representative abandoned the application after notice of allowance, since Representative disagreed with Examiner's interpretation regarding "interacting" (which of course defines how the particles are combined). Since this point is so important (page 13, paper # 12), the Examiner requires an explanation of the relationship between particles that make up this "combined particle".*

Regarding the 103 rejections (pages 13-14, paper 19):

60. Representative's characterization of the teachings of Baumann and Misaka again trivializes and misstates their inventions - ***Again***, please refer to the detailed rejections as well as the teachings. For example, the characterization of the Baumann teaching as "*...incoming spheres ...*" again ignores the teaching of a simulation of Sputtering - *that which Applicant is attempting to claim*. ***Page 4.4.2 of Baumann discloses molecular dynamic simulation (simulation of trajectories) - as mentioned in the detailed art rejection, this means that it is inherent that a***

source must exist for each particle. As per Misaka, see fig. 2; col. 9, line 65 to col. 10, line 9, wherein trajectories are discussed. Representative has not provided a persuasive response to the art rejections, repeated above.

61. In response to applicant's arguments against the references individually (namely, the Misaka and Baumann references), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Regarding the 102(B) rejections (page 14, paper 19):

62. Note that all 102 rejections have been changed to 103 rejections - however, a few comments are in order. Representative's characterization of the teaching of Reeves trivializes and misstates the invention - Please refer to the detailed rejections as well as the teachings. *For example, and Examiner would again like to point out -* ***reference to "fuzzy" is irrelevant and has absolutely nothing to do with the issues at hand.*** As recited in the last Official Office Action: "Reeves discloses ***animation of particle behavior*** and discloses the concept of combined particle. On page 91,

> *"First, an object is represented not by a set of primitive surface elements, such as polygons or patches, that define its boundary, but as clouds of* ***primitive particles*** *that define its volume."*

Section 2.1 discloses particle generation. Section 2.2 discloses:

> *"For **each new particle generated**, the particle system must determine values for the following attributes:*
>
> *(1) **initial position,***
>
> *(2) **initial velocity (both speed and direction),***
>
> *(3) initial size,*
>
> *(4) initial color,*
>
> *(5) initial transparency,*
>
> *(6) shape,*
>
> *(7) lifetime.*

Section 2.3 discloses particle dynamics."

Please note the bold-faced portions - ***which define particle sources***.

63. As recited in the last Official Office Action, "Cohen discloses "*Computer animations, quantum mechanics and elementary particles.*" See entire disclosure. The following is from pg. 165;

> *"In a typical animation, starting from a small number of virtual particles, the number tends to increase as a function of time, signaling the deviation from the physical states. A physical particle contains a cloud of finite size of virtual particles. The animation actually allows us to see the formation of such clouds. It is rather amusing to identify dressed objects mainfesting collective behavior, and then analyze the space renormalization group of the clouds by zooming in."*

On page 166, the following is found:

<u>*The visualization "dictionary" developed for computer animations of quantum systems* ***can be applied to any process following the rules of one or several of Nature's fundamental interactions. Animation of various atomic and subatomic phenomena***</u> *such as electron orbitals, particle collisions, radiactive decay, fusion, fission, etc. are therefore feasible and instructive."*

<u>*Cohen discloses particle sources*</u>**.**

64. The Examiner is confused bt Representative's argument regarding a combination of Reeves and Cohen - please remember that these were *102 rejections.*

<u>***Regarding the 102(E) rejections (page 15, paper 19):***</u>

65. Note that all 102 rejections have been changed to 103 rejections - however, a few comments are in order. As recited in the last Official Office Action: "Kinema/SIM is a software tool that presents a simulation space for particle behavior where you can construct and animate complex physical phenomena. See entire disclosure. A number of features are subsequently listed for Applicant's benefit.

- Examples of the <u>***graphical interface***</u> are shown on pp. 1-8 to 1-9;

- the "<u>***particle window***</u>" is shown on pg. 2-7; here the <u>**particle parameters can be altered**</u>;

- "Lifetime" defines the particle lifetime (pg. 2-9);

- "<u>***particle geometry***</u>" is discussed on pg. 2-11;

- "<u>***coordinate systems***</u>" are discussed on pg. 3-3;

- entering particle parameter values via slider buttons (pg. 3-10;

- probability functions for ***particle speed, lifetime, emission angles*** (pg. 3-11);

- other relevant temporal parameters (pg. 3-16);

- ***GUI simulation controls*** (pg. 5-2);

- statistical features (ie., *group behavior* - pg. 5-3);

- ***particles, obstacles*** (pg. 5-5);

- deatils about simulation parameter values including ***source rate, display, particle interactions and emission sources*** (chapter 6);

- ***range of interactions between particles*** (pg. 6-3);

- ***source rate*** (pg. 6-4);

- ***a combined particle*** (pg. 6-5), wherein

"The Euler mode, on the other hand, calculates forces more globally and therefore has the advantage of maintaining simulation speed. It calculates only one force per cell at time t, which is applied to ***all particles in the cell.*** *...";*

- Chapter 7 discloses "***Particles***";

- ***particle coupling*** (pg. 7-1);

- particle examples (pg. 7-1), wherein

"Particles are the key element in Kinema/SIM simulations. They are point objects that can represent a broad range of physical and image characteristics such as mass, charge, color, motion and geometry. In your simulation, particles can represent a diversity of real or image objects such as quantum physics particles, gas molecules, aerosol droplets, bacteria,

fluid flow, dust, rain, snow, sand, or pixels of images. The possibilities are as numerous as the phenomena of reality and creative animtion ...

... Particles are emitted into the simulation via sources which can be visible or invisible points or geometric objects positioned in simulation space. ...";

- particles parameter window (pg. 7-3 to 7-4);

- *"Sigma", a parameter related to particle-particle interactions* (pp. 7-13 to 7-14);

- decay particles (pg. 7-21);

- particle coupling (pp. 7-22 to 7-23);

- Chapter 8 (source parameters);

- ***sources*** (pg. 8-1), wherein

"Sources are orgins that emit particles into the simulation, and all particles must enter the simulation via a source. Sources can be points or have spatial geometry which you can choose to see or hide in simulation space. You can define as many sources as you like for a system, but each source is restricted to emit only one particle type. (If you want to have more than one particle type originate from the same position, you can superimpose sources at the point. ...

... In the source window you assign a particle type to the source and then define the rate and speed of the particles along with their spread angle into the simulation. ..."

The "spread angle" is Applicant's "cone".;

- source window (pg. 8-3);

- source rate (pg. 8-4);

- **Spread** (pg. 8-5);

- speed (pg. 8-6);

- ***source position*** (pg. 8-10);

- display (pg. 8-11);

- geometry (pg. 8-13);

- ***particle emission and geometry*** (pp. 8-15 to 8-16);

- ***particle generation*** (pp. 8-16 to 8-17);

- Chapter 9 "Obstacles";

- Chapter 13, "electric fields";

- Chapter 15, "***particle events***";

- elastic and inelastic particle collisions (pp. 15-1 to 15-2)".

Kinema/Sim discloses particle sources. **Representative's response is simply not credible. Examiner can only *repeat* the request that Representative please review the art rejection and the art.**

Regarding the 103 rejections (page 15, paper 19):

64. In response to applicant's arguments against the references individually (namely, the Ohira and Yamada references), one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413,

208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

65. As per emission sources - these are inherent in particle simulators. As per "*adsorbate*" and "*substrate*", please see the art rejections.

Regarding the 103 rejections (page 15, paper 19):

66. The above comments regarding the prior art also apply here.

Conclusion

67. The prior art made previously of record and not relied upon is considered pertinent to applicant's disclosure. Representative still has not provided any comments regarding the cited art.

- Bouvier et al.: "*From crowd simulation to airbag deployment: particle systems, a new paradigm of simulation.*" This publication discloses details concerning the *Kinema/Sim* software package. The reference apparently does not qualify as prior art since the date of publication is 1/97. However, the reference compactly summarizes the matter disclosed in the Kinema/Sim manual and is provided for Applicant's benefit. See particularly: Section 1, including: section 1.1 (*Introduction and Objectives*), section 1.2 (*Particle Systems*), sections 1.2.1 and 1.22; Section 2 (*Particle Systems*), especially section 2.2, wherein:

> "A particle system is defined by:
>
> The description of the **particle types**,
>
> The **particle sources which generate the sources,**

The **3D geometry, including obstacles,**

The **evolution of these particles** within the system";

section 2.2.2 wherein the particle object is defined, including, among others:

"its **values for interactions with surfaces** (stick, bounce, penetrate, transform, etc),

its **visualization parameters: color, size, transparency, trail memory, geometry"**;

section 2.2.2 (***Generation of Particles***), wherein;

"Generating particles implies the description of an initial state for the system, by defining particles of different types, with imposed positions and velocities. During the simulation, the interaction of these particles with the system will change these initial values, but the **user will have the possibility to create new particles**, with defined position and velocities.

The particles are generated by sources. Sources are geometric entities emitting only one type of particle. They are defined by:

Their **position in the space and their dimension,**

Their size and **geometry,**

Their **rate of emission as a function of time,**

Their **direction of emission: a given vector, a local normal to a surface, or a given trajectory"**;

section 2.2.3 (*Evolution of particles*); section 2.2.5 (*Advantages of the Kinema approach to particle systems*), wherein, among other things:

"the system can:

handle **collisions of particles with objects, surfaces** and **<u>with other particles</u>**,

manage the position of sources and emission parameters (rate, direction, speed)";

section 3.6 (*visualization*); and section 5 (*Further simulations under development*), wherein,

"Obstacles and source management facilites enable us to model different kinds of phantoms (scattering environment shapes and radioactive spatial distributions). ..."

- Ohta (U. S. Patent 5,751,607, Method (Sputter Deposition Simulation by Inverse Trajectory Calculation, 1998) discloses the use of Monte Carlo techniques as it pertains to the simulation of sputtering. [of record]

- Jones et al., "Monte Carlo Investigation of Electron-Impact Ionization in Liquid Xenon," Phys. Rev. B., 48, 9382-9387, 1993 teaches the use of Monte Carlo techniques as it pertains to electron transport in condensed media; references are provided to more detailed desciptions of Monte Carlo techniques. [of record]

- Takagi, "Development of New Materials by Ionized-Cluster Beam Technique," Mat. Res. Soc. Symp. Proc., 27, 501-511, 1984 discloses ion beam clusters ("combined particles") and its relation to deposition. [of record]

- Cornell Theory Center (1996) discloses an animated simulation of the dynamic failure of 3D solids under tension at the atomistic level using classical molecular dynamics and system sizes from 10 to more than 100 million atoms. [of record]

- XSIMBAD (1996) discloses a Monte Carlo simulation software package. A condition setting user template is shown on pp 3-4; animated simulation results are shown on pp. 5 and 11-12, graphical results are shown on pg. 6 and 11. [of record]

68. These references are a <u>few examples of many references which the examiner has obtained</u> concerning <u>animation as applied to simulation in general, and sputtering, in particular</u>."

69. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Hugh Jones whose telephone number is (703) 305-0023.

Dr. Hugh Jones

December 26, 2000

KEVIN J. TESKA
SUPERVISORY
PATENT EXAMINER